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ARSENIC QUANTIFICATION SAMPLING AND ANALYSIS PLAN UNIVAR USA INC. - NPDES PERMIT NO. 101613 PORTLAND, OREGON

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1.0 INTRODUCTION

On behalf of Univar USA, Inc. (Univar), PES Environmental, Inc. (PES) has prepared this Arsenic Quantification Sampling and Analysis Plan (SAP) in accordance with the Arsenic Quantification Plan (AQP; PES, 2010). The AQP was required by Univar's National Pollutant Discharge Elimination System (NPDES) Permit No. 101613, Schedule D (Special Conditions), Item 3. Specifically, the AQP was to "detail how Univar will collect additional ambient (Willamette River), intake (natural groundwater), and effluent data including and beyond that specified in the permit to identify the source and speciation of arsenic and to quantify the mass loading of arsenic."

The data generated from implementing this SAP, in addition to the other permit-required monitoring, will be used by the Oregon Department of Environmental Quality (DEQ) to determine if there might be an affirmative Reasonable Potential Analysis (RPA) finding for the applicable arsenic criterion. DEQ is in the process of revising the human health arsenic criteria and will be proposing a criterion to better reflect the more toxic speciation's of arsenic (inorganic arsenic) using a regionally appropriate health-risk calculation method. This will result in a shift of the standard from "total" to the "inorganic" arsenic fraction.

Existing arsenic concentration data is primarily only reported for total arsenic and is often reported as not detected. DEQ is requiring the collection of additional ambient and effluent data to determine inorganic arsenic concentrations and the use of better analytical techniques with lower method reporting limits.

In accordance with the AQP, Univar first conducted a review of existing surface water and groundwater arsenic concentration data in order to identify data gaps and the sampling objectives of this SAP to fill those gaps. This SAP summarizes the data review and details the tasks and methods used to collect the necessary ambient (Lower Willamette River) and intake (natural groundwater) arsenic data. The effluent data collection requirement is being fulfilled in accordance with Schedule B of the NPDES permit discharge sampling requirements. This SAP discusses objectives and purposes, project organization, the rationale and locations of the work to be performed, sampling and analytical procedures, decontamination and waste management, health and safety, quality assurance project plan, data evaluation and reporting, and schedule.

1.1 Sampling and Analysis Plan Organization

The remainder of this SAP is organized into the following seven sections:

- **Section 2 – Background.** Section 2 provides a description of the Site and current groundwater extraction system operations;
- **Section 3 – Summary of Existing Data** Section 3 summarizes the review of existing surface water and groundwater arsenic concentration data in the vicinity of the site and identifies any data gaps;
- **Section 4 – Monitoring Rationale.** Section 4 summarizes the rationale behind the groundwater and surface water sampling locations, frequency, and analytical parameters;

- **Section 5 – Field Procedures.** Section 5 provides the methods and procedures to be followed during groundwater and surface water monitoring;
- **Section 6 – Quality Assurance Project Plan (QAPP).** Section 6 identifies QAPP procedures for groundwater and surface water monitoring and laboratory analysis;
- **Section 7 – Reporting and Schedule.** Section 7 provides the process for reporting data collected under this SAP and the proposed schedule; and
- **Section 8 – References.** Section 8 provides the references cited in the sampling and analysis plan.

2.0 BACKGROUND

2.1 Site Description

The Univar property (Site) is located at 3950 NW Yeon Avenue in an industrial area northwest of downtown Portland, Oregon (Figure 1). The property is zoned "heavy industrial" and lies within an area designated as an Industrial Sanctuary in the City of Portland Comprehensive Plan. The property is located in the southwest quarter of the southwest quarter of Section 20 and the northwest quarter of the northwest quarter of Section 29, Township 1 North, Range 1 East. The property is located on Tax Lot 1800 at Latitude 45° 32' 55" and Longitude -122° 43' 22".

Properties near the Univar property include American Steel, McWhorter (also known as McCloskey Varnish), and the Shell (formerly Texaco) petroleum tank farm to the west; Container Recovery Inc. (formerly Convoy) and ABF/ASNR Trucking (formerly ANR) to the east and southeast; and Index and Wilhelm Trucking to the south. The area has been industrialized for approximately 60 years.

Univar has packaged, stored, and distributed bulk chemical products at the property since 1947. The facility encompasses approximately 9.5 acres in size including approximately 2 acres of warehouses and office space, a railroad spur, loading dock, and aboveground storage tanks. Bulk chemical products were formerly stored in 13 underground storage tanks (USTs), all of which were removed in 1985. At the time of removal, the tanks were tested and found to be tight.

Univar began recycling spent chlorinated solvents in 1973, together with the storage of certain hazardous wastes associated with those recycling activities. The recycling and storage of associated hazardous wastes was fully discontinued in 1987 and the hazardous wastes storage area of the property underwent procedural closure under Section 3008(a) of Resource Conservation and Recovery Act (RCRA) in 1988.

2.2 Groundwater Extraction System

To address historic releases of volatile organic compounds (VOCs) at the facility, Univar has entered into an Amendment to the Administrative Order on Consent to Implement Corrective Action 1087-10-18-3008 (AOC Amendment) dated August 1, 2007, with the United States Environmental Protection Agency (USEPA) Region 10. Consistent with the Corrective Measures Implementation (CMI) Work Plan prepared pursuant to the AOC Amendment, Univar is implementing a variety of corrective actions at the Site, including operating a groundwater extraction and treatment system as an Interim Control Measure (ICM).

The groundwater extraction system currently consists of two groundwater extraction wells located on-site. The groundwater is first treated with a sequestering agent to keep iron in the dissolved state. Next, a particulate filter is on-line whenever there is a likelihood of particulates in the water (e.g., during line cleaning activities). The filter is followed by a shallow tray air stripper to remove VOCs. The effluent is discharged to a storm sewer which leads to Outfall #18 and the Willamette River. The discharge of treated groundwater is authorized by DEQ by NPDES Permit No. 101613, first issued in 1998 and renewed in 2004 and 2010.

Based on the data Univar provided in its most recent NPDES permit reapplication package in 2008 (for the 2010 permit renewal), DEQ concluded that there may be a "reasonable potential" for arsenic to exceed the applicable water quality criteria at the edge of the approved mixing zone. Therefore, consistent with the interim approach outlined in DEQ's *Internal Management Directive – Interim Procedure for Addressing Naturally Occurring Arsenic in NPDES Permits* (DEQ, 2010), a total arsenic effluent numeric benchmark and the collection of total arsenic and total inorganic arsenic, with specified quantification limits, was added to the renewed permit. In addition, per Schedule D of the permit, Univar was required to prepare an Arsenic Quantification Plan. This SAP was prepared in accordance with the AQP.

3.0 SUMMARY OF EXISTING DATA

Consistent with the procedure outlined in the AQP, Univar first conducted a review of existing surface water and groundwater arsenic concentration data in order to identify data gaps and to develop the sampling objectives of this SAP to fill the data gaps.

3.1 Ambient (Willamette River)

Consistent with DEQ's guidance presented in the Reasonable Potential Analysis (RPA) Internal Management Directive (IMD; DEQ 2005),Univar reviewed the United States Geologic Survey (USGS) databases, the USEPA STORET database, and DEQ's LASAR database to evaluate arsenic concentrations in the receiving waters. Univar researched surface water arsenic concentration data from the Willamette River both upstream and downstream of Outfall #18 (River Mile 9). In addition, Univar researched the existence of any additional surface water arsenic studies, especially any data gathered by other applicants for NPDES permits at or near Outfall #18 and/or in studies conducted by the Lower Willamette Group (LWG) as part of their activities associated with the Portland Harbor Superfund Site.

USGS NWIS Database:

Univar queried arsenic data from the USGS NWIS on-line database located at http://nwis.waterdata.usgs.gov/or/nwis/qwdata. Searches for five arsenic parameter codes (00978, 00997, 01000, 01001, 01002) for streams in Multnomah County resulted in data for two downstream locations within the Willamette River (St Johns Bridge at River Mile 5.8 and Linnton at River Mile 5). The available dissolved and/or total arsenic data for these two locations indicated concentrations below the method reporting limit (MRL) of 1 micrograms per liter (µg/L) for samples collected in 1992 and 1996.

A query for arsenic data at USGS Station 14211720 (upstream at River Mile 11) resulted in dissolved arsenic data for 153 samples collected from 1975 through 2005 and total arsenic data for 33 samples collected from 1974 through 1982. The majority of the data from 1974 through 2000 indicated dissolved arsenic concentrations below the MRLs which ranged from 1 to 2 µg/L. The limited amount of total arsenic data indicated similar total and dissolved arsenic concentrations (i.e., below MRLs). The MRL was lowered for 12 samples collected in 2004 and 2005 and the average dissolved arsenic concentration for these samples was 0.37 µg/L.

USEPA STORET Database:

On December 8, 2010, Univar queried arsenic data from the USEPA STORET on-line database located at http://www.epa.gov/storet/ . Searches for arsenic data within rivers and streams in Multnomah County, Oregon returned zero stations and results.

DEQ's LASAR Database:

On December 3, 2010, Univar queried arsenic data from the DEQ LASAR on-line database located at http://www.deq.state.or.us/lab/lasar.htm for the following stations:

LASAR Station #	River Mile	EPA Storet #	Description
10332	7	402000	Willamette R. at SP&S RR Bridge
10611	13.2	402288	Willamette R. at Hawthorne Bridge

Arsenic surface water concentration data has been collected and reported in the LASAR on a monthly basis from April 2008 through February 2010 for both stations. Total recoverable arsenic was not detected above the laboratory Level of Quantitation (LOQ) at either station location through the January 2010 sampling event. The LOQ was reported to be 2.0 µg/L. The LOQ was lowered in the February 2010 sampling event at station 10611 and total recoverable arsenic was reported at a concentration of 0.38 µg/L. The LOQ remained elevated for the February 2010 data collected at station 10332.

Lower Willamette Group Data:

Univar reviewed DRAFT LWG reports located at http://yosemite.epa.gov/R10/CLEANUP.NSF/ph/technical+documents#draftri and the *Portland Harbor Superfund Site Draft Remedial Investigation Report* (LWG, 2009). The LWG conducted surface water sampling during Round 2 and Round 3 sampling events during the Portland Harbor RI/FS activities from 2004 through 2008. Total arsenic concentrations within the Willamette River at River Mile 11 (upstream) ranged from 0.197 to 0.485 µg/L and dissolved arsenic ranged from 0.186 to 0.44 µg/L. Total arsenic concentrations within the Willamette River near River Mile 9 ranged from 0.37 to 0.67 µg/L and dissolved arsenic ranged from not detected at or above the MRL of 0.39 to 0.49 µg/L.

Additional Data Sources:

Univar reviewed a report for the McCormick and Baxter property, located at River Mile 7 (downstream) which reported total arsenic data for 21 surface water grab samples adjacent to the property. Total arsenic was detected in 17 samples at concentrations ranging from not detected at or above the MRL of 0.503 µg/L to a maximum detection of 2.06 µg/L. The furthest upstream sample result (closest to Univar Site) indicated a total arsenic concentration of 0.956 µg/L (E and E, 2005).

3.2 Intake (Groundwater)

Univar conducted a review of the site and surrounding properties in order to evaluate arsenic concentrations in groundwater within the vicinity of the site. This data will be used to assist Univar in determining the site-specific background concentrations of arsenic in groundwater in the water treatment system intake.

Univar Property

Numerous environmental investigations have been conducted of surface soils, subsurface soils, and groundwater at the site. Univar reviewed all historical site analytical data in regards to arsenic concentrations detected at the site.

A Health and Environmental Assessment (HEA) was conducted as part of the 1993 RFI (HLA, 1993). The HEA used data collected during Phase I and Phase II investigations conducted in 1987 (HLA, 1987a, b). Per Table G6 of the HEA, arsenic was detected in one surface soil sample at a concentration of 4.8 milligrams per kilogram (mg/kg). Arsenic is not included in the statistical summary for subsurface soils and was either not detected or not analyzed. Per Table G3, arsenic was detected in groundwater from well SMW-06 at a concentration of 40 µg/L. Arsenic was included as a chemical of potential concern (COPC) but was not retained as a chemical of concern (COC) for either soil or groundwater and additional arsenic data was not collected.

Univar collects and analyzes samples of the influent to the water treatment system on a monthly basis and collects and analyzes samples of the extraction wells on a quarterly basis. The samples are currently analyzed for VOCs only and have not been analyzed for arsenic.

USGS

The USGS prepared a report titled *Arsenic in Ground Water of the Willamette Basin, Oregon* (USGS, 1999) which summarized historical USGS data in the NWIS database, data from two USGS studies, as well as data collected predominantly from domestic wells in 1996 and 1997. This report did not include specific arsenic concentration data for wells located within the vicinity of the site but found that concentrations of arsenic in the study ranged from less than 1 to 2,000 µg/L and concentrations in 8.0 percent of the samples exceeded the USEPA Maximum Contaminant Level at that time of 50 µg/L.

On December 21, 2010, Univar queried arsenic data from the USGS NWIS on-line database located at http://nwis.waterdata.usgs.gov/or/nwis/qwdata. Searches for five arsenic parameter codes (00978, 00997, 01000, 01001, 01002) for well data within Multnomah County resulted in data for 27 sites with six sites in the same township and range as the Univar Site. These six wells ranged in total depths from 96.25 to 245 feet below ground surface. Total arsenic data from 1995 to 1998 ranged from 1 to 3 µg/L in samples collected from these wells. Given the depth of these wells, this data does not appear to be useful for evaluating naturally occurring

arsenic concentrations in the shallow groundwater that is the "intake" source for the Univar groundwater treatment system.

SDWIS

On February 18, 2011, Univar queried arsenic data from the Oregon Department of Health Services Drinking Water Program Safe Drinking Water Information System (SDWIS) on-line database located at http://www.oregon.gov/DHS/ph/dwp . Searches for drinking water data within Multnomah County resulted in data for 16 sites. Univar reviewed select sites for arsenic data within the vicinity of the Univar Site. Arsenic concentrations of 6.0 to 7.0 µg/L were reported in samples collected from two wells located approximately 7 to 9 miles northwest of the Site. Given the distance of these wells from the site, this data does not appear to be useful for this evaluation.

DEQ file review for surrounding properties:

Univar reviewed the DEQ ECSI on-line database (www.deq.state.or.us/lq/ECSI) to select sites for conducting a detailed file review. The following is a summary of groundwater arsenic data for surrounding properties where arsenic data was available (locations shown on Figure 2):

- Shell/Texaco Terminal – 3800 NW St. Helens Road: this site is located approximately 400 feet northwest of the Univar Site. An investigation conducted in 1993 indicated total arsenic in five out of eight samples at concentrations ranging from 11 to 33µg/L and dissolved arsenic in five out of eight samples at concentrations ranging from 7 to 27 µg/L,
- Carson Oil – 3125 NW 35th Avenue: this site is located approximately 800 feet southeast of the Univar Site. One groundwater sample was analyzed for arsenic during an investigation conducted in 1992. Total arsenic was not detected at a MRL of 100 µg/L;
- Burlington Northern Railroad Lake Yard – 3500/3930 Yeon Avenue: this site is located across Yeon from the Univar site (north). Numerous investigations have been conducted at this site which indicated total and dissolved arsenic in groundwater up to 25.3 and 17 µg/L, respectively;
- Container Recovery Site – 3900 NW Yeon Avenue: This site borders the eastern boundary of the Site. An investigation conducted in May 2002 indicated total arsenic was detected in three of five groundwater samples at concentrations ranging from 6.5 to 21.5 µg/L (Bridgewater, 2004); and
- Columbia American Plating – 3003 NW 35th Avenue: This site is located approximately ½-mile southeast of the Univar Site. Based on a review of Table D-7 of the *Removal Action Report* (START, 2004), arsenic concentrations in groundwater samples ranged from ND to 22.1 µg/L. Groundwater sampling dates and locations were not immediately available for review.

3.3 Effluent (Water Treatment System)

Effluent samples were analyzed for total arsenic in April, 2003, November 2008, and total inorganic arsenic in January and February 2010 as part of the most recent NPDES permit renewal application process. The total arsenic concentrations in effluent samples collected in 2003 and 2008 were 26.8 and 29.4 µg/L, respectively. Total inorganic arsenic concentrations in the water treatment system discharge in January and February 2010 were 24.9 and 26.5 µg/L, respectively.

Beginning in October 2010, effluent samples will be analyzed for total arsenic and total inorganic arsenic on a quarterly basis, per the current NPDES permit. Results for the water treatment system effluent samples collected beginning in October 2010 are summarized on the DMR forms submitted on a quarterly basis.

3.4 Identification of Data Gaps

DEQ requires a minimum of 10 ambient and effluent data points (or two and a half years of quarterly monitoring) to adequately characterize the effluent and to conduct the RPA (DEQ, 2010). DEQ is requiring the data collection of both total arsenic and inorganic arsenic in order to conduct the RPA. Inorganic arsenic concentration data was not encountered in Univar's review of existing ambient and groundwater data in the vicinity of the Site. Therefore, 10 sets of arsenic concentration data from the Willamette River need to be collected in order to obtain the arsenic speciation information. Univar will periodically review the sources discussed in Section 3.1 for additional surface water arsenic data. The existing NPDES permit effluent requirements will allow for the collection of 10 effluent data points by the mid-permit term.

The source of the arsenic in the groundwater at the Univar site is not known. Facility processes and chemicals handled at the facility are not believed to be a source of arsenic. Groundwater monitoring data from nearby sites suggest that at least a portion of the arsenic in the groundwater at the site may be the result of natural background concentrations of arsenic or from an off-site source. However, it is possible that the effects of the VOC contamination at the site have altered the geochemical conditions in the subsurface such that there has been increased dissolution of naturally occurring arsenic from the site soils into groundwater. Additional groundwater data needs to be collected in order to characterize site-specific background concentrations and also evaluate whether changes in site geochemistry compared to background have resulted in additional arsenic being present in the groundwater. This data may be used to allow for an intake credit and the deduction of arsenic from groundwater sources from the RPA calculation (DEQ, 2010).

4.0 MONITORING RATIONALE

This section discusses the requirements, approach, and rationale for the SAP to fill the data gaps identified in the previous section. Section 5 details the methods and procedures that will be used to implement the approach described in this section.

4.1 Monitoring Locations

4.1.1 Intake (Natural Groundwater) Sampling

Two aquifers and two aquitards have been identified beneath the site. The sandy lower part of the dredge fill composes the shallow aquifer. This aquifer is present throughout the site. Native silt and clay compose the intermediate aquitard which serves as a barrier to downward groundwater flow; as well as a barrier to horizontal groundwater flow, directing flow to the north and south, beneath the site. Groundwater in the shallow aquifer flows toward the site from the west and splits into southerly and northerly flow beneath the site. The ICM extraction wells are located within the shallow aquifer and have created well-defined cones of depression around each well. A total of 38 wells (SMW-1 through SMW-38) and 13 piezometers (PZ-1 through PZ-13) make up the shallow groundwater monitoring network (Figure 3). The groundwater extraction system is currently extracting water from EXW-2 and EXW-3 (soon to be replaced by new well EXW-3A).

Off-site/upgradient wells for determining off-site/background arsenic concentrations include four wells located on the American Industries property (SMW-13, SMW-15, SMW-18, and SMW-19) and well SMW-20 on Index Steel property. Univar is currently negotiating an off-site access agreement with American Industries to monitor these wells. The source area groundwater conditions are represented by a number of wells SMW-04, SMW-07, SMW-36, SMW-37, and SMW-38. Due to the presence of non-aqueous phase liquids (NAPLs), wells SMW-36, SMW-37, and SMW-38 are frequently not sampled. Wells SMW-10 and SMW-24 are located downgradient of extraction wells EXW-3A and EXW-2, respectively. These wells have very low or nondetectable levels of VOC contamination and may useful in characterizing conditions outside the VOC plume.

Univar has selected SWM-10, SMW-20, and SWM-24 to be utilized for determining off-site/background arsenic concentrations and SMW-04, SMW-07, and the ICM influent water from EXW-2 and EXW-3A to determine concentrations of arsenic in the shallow aquifer beneath the site.

4.1.2 Ambient (Surface Water) Sampling

Background arsenic data within the receiving waters is needed for DEQ to make an RPA determination. The Regulatory Mixing Zone is defined in the NPDES permit as extending 10 meters across the river, 10 meters downstream, and 5 meters upstream. The Zone of Initial Dilution is defined in the NPDES permit as extending 1 meter across the river, 1 meter downstream, and 0.5 meters upstream. Surface water samples will be collected from a location

upgradient of Outfall #18 (SW-1) as shown on Figure 4. This location is outside of the Regulatory Mixing Zone in order to characterize the receiving waters.

4.2 Monitoring Frequency

Univar conducts routine semi-annual groundwater sampling at the Site in the 2nd and 4th quarters and arsenic will be added to the analyte list during this routine sampling for the wells identified in Section 4.1.1. In addition to this routine sampling, Univar will conduct additional groundwater sampling events so that quarterly arsenic data is collected from the wells identified in Section 4.1.1.

Univar collects and analyzes samples of the influent to the water treatment system on a monthly basis and collects and analyzes samples of the extraction wells on a quarterly basis. Arsenic analysis will be added to these routine sampling analyte lists.

Surface water samples will be collected on a quarterly basis in order to obtain 10 data points by the mid-permit term (2 ½ years).

4.3 Analytical Parameters

The analytical program will consist of the collection of field parameters (temperature, pH, specific conductance, and dissolved oxygen) and laboratory analysis of total and dissolved arsenic by USEPA Method 200.8 and total and dissolved inorganic arsenic by USEPA Method 1632.

5.0 FIELD PROCEDURES

5.1 Sampling Objectives and Tasks

The SAP for the project has been developed to collect high quality environmental data which are acceptable for use by DEQ in evaluating the source and speciation of arsenic in regards to the NPDES discharge permit. Specific sampling tasks for this investigation are as follows:

- Monitor groundwater conditions to provide an assessment of the distribution and concentrations of arsenic at the Site which is being extracted by the groundwater treatment system and ultimately discharged to the Willamette River, and;
- Collect surface water arsenic concentration and speciation data within the Willamette River to characterize the effluent discharge receiving waters.

5.2 Groundwater Sampling Procedures

Groundwater level measurements and sampling will be conducted in accordance with the Data Collection Quality Assurance Plan (DCQAP; HLA, 1989) and as follows:

5.2.1 Water Level Measurement Procedures

As part of Univar's routine groundwater monitoring and sampling activities, groundwater levels will be measured quarterly in all 38 shallow aquifer monitoring wells, 7 deep aquifer monitoring wells, 7 piezometers, and 4 extraction wells within the groundwater monitoring network. Groundwater level measurements for the entire site will be completed on the same day. Groundwater level measurements will only be collected in the wells identified in Section 4.1.1 during sampling activities related to this SAP. Access to off-site monitoring locations will be coordinated prior to mobilization to the field. Groundwater levels will be measured using the following procedures:

1. Open the well monument, remove any standing water and debris (i.e., sediment, vegetation, or refuse) prior to removing the well cap;

2. Open the well by carefully removing the well cap and allow the well to vent. Record the time at which the well is initially vented to the atmosphere (i.e., time of well cap removal). Document initial conditions (i.e., well over-pressurized or under-pressurized relative to the atmosphere) on the Water Level Form (Appendix A);

3. After opening and venting the well, measure the initial water level to the nearest 0.01 foot, using electronic water level probe;

4. Measure the water level at the surveyed measuring point (MP) on the north side of the top of the PVC casing;

5. Duplicate the water level measurement in each well in the field to ensure that the reading is accurate. Record all results (times, measured values, etc.) on the Water Level Form;

6. Rinse the probe tip with distilled water between each well to avoid cross contaminating monitoring wells;

7. Replace the well cap on each shallow well upon completing the water level measurement; and

8. Upon completion of the water level measurements, replace and tightly seal each of the well caps and surface monuments.

5.2.2 Sampling Preparation

Prior to the initiation of any sampling activities, all of the necessary field equipment and documentation materials (e.g. field notebook and sampling forms) will be prepared. A summary of the sampling tools and equipment to be used during the SAP activities are listed in Table 1. Prior to the commencement of purging and sampling, each of the field instruments will be calibrated with standard solutions at a minimum of once per day. Laboratory supplied sample bottles will be inspected for proper preservative (Section 5.4). The depth to water will be measured prior to sampling using the procedures outlined in Section 5.2.1.

5.2.3 Low-Flow Purging with Peristaltic Pump

New disposable polyethylene tubing will be used to sample each monitoring well. The polyethylene tubing will be slowly lowered into the well until the tubing intake is at the mid-point of the well screen. The monitoring well will be purged with the peristaltic pump fitted with new disposable silicon tubing in the pump head. The polyethylene tubing in the well will be connected to the silicon tubing in the pump head. The time will be recorded on a Groundwater Sampling Form (Appendix A), and the pump will be started. Pumping rates will be measured with a stopwatch and graduated cylinder, graduated cup, or volatile organic analysis (VOA) 40 milliliter (mL) vial, depending on flow rate. Low flow purging will be conducted at a pumping rate between 80 and 500 mL per minute (mL/min).

During purging, the water level will be measured approximately every 3 to 5 minutes, until a steady water level is determined. If possible, a drawdown of 0.3 feet or less will be maintained in the well, with the pumping rate lowered to a minimum rate of 80 mL/min if necessary to maintain a drawdown of 0.3 feet or less. The water level in the well will be maintained above the tubing intake depth at all times. If the well yield is sufficiently poor that the water level drops to the tubing intake, the pump will be stopped until the water level recovers to near the pre-pumping level. The process will then be repeated until the field parameters have stabilized. The final purge volume will be at least as great as the submerged tubing volume plus the stabilized drawdown volume. All measured water levels and pumping rate changes will be recorded on a Groundwater Sampling Form.

5.2.4 Field Parameter Measurements

Field indicator parameters will be measured approximately every 3 to 5 minutes during purging. Field parameters will include pH, specific conductance, temperature, dissolved oxygen (DO),

and oxidation-reduction potential (ORP). Measurements will be recorded to the following standards:

- pH to ±0.01 units;
- Specific conductance to ±1 micro ohm;
- Temperature to ±0.1°C;
- DO to ±0.1 milligrams per liter (mg/L); and
- ORP to ±1millivolts (mV).

Samples will not be collected until these parameters have stabilized for three consecutive readings to the following criteria:

- pH to ±0.1 pH unit;
- Conductivity to ±3 percent;
- Temperature to ±3 percent; and
- DO to ±10 percent.

ORP measurements will not be used to determine stability. If field parameters do not stabilize after 1 hour of pumping, a sample will be collected. Well purging data will be recorded on a Groundwater Sampling Form. Field instruments will be calibrated using known, standard solutions, a minimum of once per day.

5.2.5 Sample Collection

Upon completion of purging, samples will be collected from the discharge end of the peristaltic pump tubing. The same pump rate used at the end of well purging will be used during sample collection. All sample containers will be prepared and provided by the analytical laboratory. Dissolved arsenic samples will be field-filtered using a 0.45 micrometer filter installed on the discharge end of the peristaltic pump tubing.

After collection of the sample from each well, the polyethylene tubing will be removed from the well, the well cap will be replaced, and the well cap or monument locked. All used tubing will be discarded appropriately.

Decontamination and purge water will be handled in accordance to the residuals management procedures outlined in Section 5.8.

5.3 Surface Water Sampling Procedures

5.3.1 Sampling Preparation

Prior to the initiation of any sampling activities, all of the necessary field equipment and documentation materials (e.g. field notebook and sampling forms) will be prepared. A summary of the sampling tools and equipment to be used during the surface water sampling activities are listed in Table 1. Prior to the commencement of sampling, each of the field instruments will be

calibrated with standard solutions at a minimum of once per day. Laboratory supplied sample bottles will be inspected for proper preservative (Section 5.4). The gage height of the River will be determined as described below.

The Willamette River is approximately 2,100 feet wide in the vicinity of Outfall 18 and the proposed sampling location. A 2009 Bathymetry conducted for the LWG indicates the riverbed elevation near Outfall 18 is approximately -20 feet Columbia River Datum (CRD; equivalent to -15 feet NAVD 88). River information including stream velocity, gage height, and discharge flow will be obtained from the USGS web-site: http://waterdata.usgs.gov/nwis/sw. USGS Station 14211720 is located at River Mile 12.8. Based on an average river surface gradient of 0.0005 (Wallick et al, 2007), the gage height of the River at RM 9 is assumed to be 10 feet lower than the gage height reported by the USGS at Station 14211720.

Precipitation totals for the sampling dates will be obtained from the Yeon Rainfall Gage located at 3395 NW Yeon and posted at the USGS web-site: http://or.water.usgs.gov/non-usgs/bes/yeon.html.

5.3.2 Field Parameter Measurements

Field indicator parameters will be measured using a flow-through cell and multi-meter field instrument. Field parameters include pH, specific conductance, temperature, DO, and ORP. Measurements will be recorded to the following standards:

- pH to ±0.01 units;
- Specific conductance to ±1 micro ohm;
- Temperature to ±0.1°C;
- DO to ±0.1 milligrams per liter (mg/L); and
- ORP to ±1millivolts (mV).

Field instruments will be calibrated using known, standard solutions, a minimum of once per day.

5.3.3 Sample Collection

Samples will be collected using a peristaltic pump from a boat. The boat will be steered from a downstream direction to within 20 feet of the sample location and the engine turned off. The anchor will be dropped and the location will be noted with a GPS. New flexible peristaltic pump tubing [Styrene/Ethylene/Butylene/Silicone (SEBS)] and new hard case tubing [Polytetrafluoroethylene (PTFE)] will be used during each sampling event. The depth of the Willamette River in the vicinity of the sample location is estimated to be greater than 2 meters, therefore the sample intake tubing will be placed at a depth of approximately 0.5 m (1.64 feet) beneath the water surface (DEQ, 2009) as measured with calibrated rope. The tubing will be weighted with a non-metallic weight and lowered using a rope and pulley system (or a metal-free sampling pole) on the bow of the boat. The pre-cleaned and preserved sample bottles will be filled directly from the pump tubing discharge, capped, double-bagged and placed on ice.

Decontamination and purge water will be handled in accordance to the residuals management procedures outlined in Section 5.8.

5.4 Laboratory Analytical Procedures

All samples will be submitted to Columbia Analytical Services Inc., of Kelso, Washington for laboratory analysis of total and dissolved arsenic and total and dissolved inorganic arsenic. The table below lists the sample bottle type, preservation, hold times, method detection limits (MDLs), and method reporting limits (MRLs):

Analyte	CAS	Method	Container	Preservative	Hold Time	MDL (µg/L)	MRL (µg/L)
Arsenic	7440-38-2	EPA 200.8	500 ml Poly	4 ± 2°C, HNO_3 to pH < 2	6 months	0.20	0.50
Inorganic Arsenic	7440-38-2	EPA 1632	250 ml Poly	4 ± 2°C, HCl to pH < 2	28 days	0.003	0.02

5.5 Sample Labeling, Shipping, and Chain-of-Custody

Sample labeling, shipping, and chain-of-custody will be performed consistent with the procedures described below.

5.5.1 Sample Labeling

Sample container labels will be completed immediately before or immediately following sample collection. Container labels will include the following information:

- Project name;
- Groundwater Sample Name: monitoring well location followed by the date sampled. For example, the sample name for a groundwater sample collected at monitoring well MW-5 on July 1, 2011, would be "MW-5-070111";
- Surface Water Sample Name: Surface water sampling location followed by the date sampled. For example, the sample name for a surface water sample collected at SW-1 on July 1, 2011 would be "SW-1-070111";
- Initials of collector;
- Date and time of collection; and
- Analysis requested.

5.5.2 Sample Shipping

Samples will be transported via courier to the analytical laboratory using the following procedures:

- Sample containers will be place in a sealed, iced cooler after sample collection. This cooler will be used for transporting the samples to the analytical laboratory;
- In each cooler, glass bottles will be separated by a shock absorbing material to prevent breakage and leakage;
- Ice sealed in separate plastic bags or "gel ice" packs, will be placed into each cooler with the samples;
- All sample coolers will be accompanied by a chain-of-custody form (COC). The completed form will be sealed in a plastic bag, which will be taped to the inside lid of the cooler;
- Signed and dated COC seals will be placed on all coolers; and
- The name and address of the analytical laboratory, along with PES's name and office (return) address, will be placed on each cooler prior to transportation to the lab.

5.5.3 Chain-of-Custody

Once a sample is collected, it will remain in the custody of the sampler or other PES personnel until transported to the laboratory. Upon transfer of sample possession to subsequent custodians, a COC will be signed by the persons transferring custody of the sample container. A signed and dated COC seal will be placed on each cooler prior to transport. COC records will be included in the analytical report prepared by the laboratory.

5.6 Documentation

5.6.1 Intake (natural groundwater)

A description of the sampling information will be recorded on groundwater sampling forms for each sampling event. Sampling information recorded on the form will include the following:

- Date and time of sampling;
- Sampling location;
- Names of sampling team members;
- Sampling technique;
- Parameters to be analyzed;
- Field parameter measurements: pH, specific conductance, ORP, dissolved oxygen, and temperature;
- Depth to water;
- Purge rate and volume

- Record weather conditions at the time of sampling; and
- Unusual circumstances.

5.6.2 Surface Water

A description of the sampling information will be recorded on a surface water sampling form for each sampling event. Sampling information recorded on the form will include the following:

- Date and time of sampling;
- Sampling location, determined with a GPS unit;
- Names of sampling team members;
- Sampling technique;
- Parameters to be analyzed;
- Field parameter measurements: pH, specific conductance, ORP, dissolved oxygen, and temperature;
- River flow rate, gage height, and river depth at time of sampling;
- Record weather conditions at the time of sampling and visual observations of surface water: sheen, odor, color, and floatables; and
- Unusual circumstances.

5.7 Decontamination

Decontamination procedures will be performed consistent with the procedures described below. All non-disposable sampling equipment will be decontaminated prior to initial use, between sampling locations, and at the completion of the site-specific sampling.

The following decontamination procedure will be used for non-dedicated and non-disposable sampling equipment:

- Tap water rinse;
- Non-phosphatic detergent (e.g., Liquinox) and tap water wash;
- Tap water rinse; and
- Distilled water rinse.

Decontamination of personnel involved in sampling activities will be accomplished as described in the site-specific health and safety plan.

5.8 Sampling Residuals

The following procedures will be used for the investigation residuals, including groundwater sampling purge water and decontamination water:

- Purge water generated during the investigation activities will be placed containers and transported to the ICM treatment building where they will be processed through the air stripper.
- Decontamination water will be placed in 55-gallon drums and stored on site. The drums will be managed as Satellite Accumulation drums and stored in the appropriate areas until the drum is full or sampling activities completed at which time a representative sample will be collected and analyzed for disposal characterization. Based on the results, the water will be profiled and disposed of at an appropriate facility; and
- Disposable clothing and equipment will be placed in plastic bags and disposed of as solid waste in a Univar trash receptacle.

5.9 Health and Safety

The Site Health and Safety Plan for the Univar facility will be updated to reflect health and safety procedures related to over-water operations on a boat. The boat operator will have a Boater Education Card and proper safety equipment (personal flotation devices, flags, etc.) will be utilized.

6.0 QUALITY ASSURANCE PROJECT PLAN

The quality assurance project plan (QAPP) describes the measures undertaken so that the data collected during the project are acceptable for their intended use(s). The specific requirements pertaining to this monitoring plan are described in this section.

6.1 Quality Assurance Project Plan Objectives

The overall QAPP objective for measurement data is to provide data of known and acceptable quality. All measurements will be made to yield accurate and precise results representative of the media and conditions measured. Chemical analyses will be performed in accordance with the requirements of the analytical methods. All sample results will be calculated and reported in consistent units to allow comparison of the sample data with regulatory criteria and federal, state, and local databases. QAPP objectives for precision, accuracy, and completeness have been established for each measurement variable, where possible, and are discussed below.

6.2 Chemical Analyses

Analysis of environmental samples will be performed in accordance with the laboratory analytical methods summarized in Section 5.4. The laboratory will report both the MRL and MDL. Any special analytical methods or modifications to methods will be determined with laboratory concurrence prior to beginning sample analysis.

6.3 Laboratory Quality Control

This section presents quality control (QC) requirements for the analytical laboratory. The purpose of this QC program is to produce data of known quality meeting project objectives and the requirements of the standard methods of analysis. Laboratory QC samples will include laboratory control samples (LCSs), matrix spike/matrix spike duplicate (MS/MSD) samples, and method blanks. Laboratory QC samples (e.g., blanks and LCSs) will be included in the preparation batch with the field samples. An analytical batch is a number of samples (not to exceed 20, including the associated laboratory QC samples, MSs and MSDs) that are from a similar matrix and extracted or digested at the same time, analyzed sequentially, and with the same lot of reagents. The following table summarizes the laboratory quality control limits:

Analyte	Parameter	Accuracy (%R)	Precision (%RPD)
Arsenic	LCS/LCSD	85-115	≤30
	MS/MSD	70-130	≤30
Inorganic Arsenic	LCS/LCSD	80-120	≤35
	MS/MSD	50-150	≤35

quality will be performed using the USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review (USEPA, 2004) as guidelines for data review.

Laboratory deliverable requirements are outlined below and included in Table 3:

- Narrative cover letters for each sample batch will include a summary of any QC, sample, shipment, or analytical problems, and will document all internal decisions. Problems will be outlined and final solutions documented;
- A copy of the signed chain-of-custody form for each batch of samples will be included in the results packet;
- Sample concentrations will be reported on standard data sheets in proper units and to the appropriate number of significant figures. For undetected values, the lower limit of detection for each compound will be reported separately for each sample. Dates of sample extraction or preparation and analysis must be included;
- A method blank summary will be included;
- Surrogate percent recovery will be calculated and reported;
- LCS results will be included;
- MS/MSD percent recoveries, spike level, and relative percent difference will be included; and
- Laboratory duplicate results will be included.

7.0 REPORTING AND SCHEDULE

Univar will coordinate and conduct a surface water sampling event within 60 days of approval of this SAP. Arsenic will be added to the analyte list for the routine groundwater and extraction well sampling event planned for May 2011, pending approval of this SAP. Arsenic will be added to the analyte list for the routine WTS influent sampling planned for April 2011, pending approval of this SAP.

Per the NPDES permit, Discharge Monitoring Report (DMR) forms are submitted by the 15th day of the month, following the routine treatment system effluent sampling. Data generated by the approved SAP will be summarized and submitted with these monthly DMR forms.

Consistent with the Permit requirements, after two and a half years (permit mid-term), at the Pre-application Conference (to occur around January 2013), Univar and DEQ will evaluate the collected data to determine whether there is an affirmative RPA finding for the applicable inorganic arsenic criterion. The need for further actions in regards to arsenic data collection and/or treatment will be decided based on this RPA evaluation.

8.0 REFERENCES

Bridgewater Group, Inc., 2004. *Soil and Groundwater Remedial Investigation* Container Recovery Site, September 17.

Ecology and Environment, Inc. (E and E), 2005. *Final Surface Water, Pore Water, and Crayfish Fall 2003 Sampling Event.* McCormick & Baxter Creosoting Company Site. April.

Harding Lawson Associates (HLA), 1987a. *Phase I Site Investigation, Van Waters and Rogers, Inc., Portland, Oregon.* September 25.

Harding Lawson Associates (HLA), 1987b. *Phase II Site Investigation, Van Waters and Rogers, Inc., Portland, Oregon.* November 23.

Harding Lawson Associates (HLA), 1989. *Data Collection Quality Assurance Plan.* Prepared for VW&R. February 14.

Harding Lawson Associates (HLA), 1993. *RCRA Facility Investigation Report, Van Waters & Rogers Inc., 3950 NW Yeon Avenue, Portland, Oregon, Volume 1.* Prepared for VW&R. July 15.

Lower Willamette Group (LWG), (2009). *Draft Remedial Investigation Report.* Portland Harbor RI/FS. October 27.

Superfund Technical Assessment and Response Team (START), 2004. *Columbia American Plating Removal Action Report.* May.

Oregon Department of Environmental Quality (DEQ), 2005. *Reasonable Potential Analysis for Toxic Pollutants Internal Management Directive.* September.

Oregon Department of Environmental Quality (DEQ), 2009. *Water Monitoring and Assessment Mode of Operations Manual (MOM).* March 10.

Oregon Department of Environmental Quality (DEQ), 2010. *Interim Procedure for Addressing Naturally Occurring Arsenic in NPDES Permits*, Internal Management Directive. May.

PES Environmental, Inc. (PES), 2010. *Arsenic Quantification Plan.* December 3.

U.S. Environmental Protection Agency (USEPA), 2004. *USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review.* USEPA Office of Solid Waste and Emergency Response.

United States Geological Survey (USGS), 1999. *Arsenic in Ground Water of the Willamette Basin, Oregon.*

Wallick et al, 2007. *"Patterns and Controls on Historical Channel Change in the Willamette River, Oregon, USA." Large Rivers: Geomorphology and Management.*

TABLES

Field Equipment and Supplies
Arsenic Quantification SAP
Univar Facility, Portland, Oregon

Forms/Documentation
Field logbooks
Field sampling data sheets
Chain-of-custody/laboratory analysis report form
Custody seal
Project photo log
Health and Safety Plan (HASP)
Field sampling and analysis plan (SAP)
Large scale site map
Tools
Fiberglass tape with stainless-steel weight
Tape measure calibrated to 0.1 inch
Decon brushes
Flashlight
Tool kit
Groundwater Sampling Equipment
pH/conductivity/temperature meters
dissolved oxygen/oxidation reduction potential/turbidity meters
Water-level probe
Meter calibration solutions
Peristaltic pump
Glass beakers
pH paper
Polyethylene Tubing
Silicon Tubing for peristaltic pump
Sample containers and labels
Liquinox
Distilled Water
Surface Water Sampling Equipment
pH/conductivity meter/dissolved oxgen
pH paper
Thermometers (°C)
Peristaltic Pump
Polyethylene Tubing
Silicon Tubing for peristaltic pump
Boat with anchor
Calibrated Rope and Pulley System
Non-metallic Weights
Plastic sample collection containers, Teflon® lined caps, and labels.
Global Positioning System (GPS)
0.45-micron filter paper
Distilled water
Cellular phone (if needed)

Field Equipment and Supplies
Arsenic Quantification SAP
Univar Facility, Portland, Oregon

Health and Safety Equipment
Fire extinguisher
Personal Flotation Device (PFD)
First aid kits
Safety glasses
Eyewash
Ear plugs
Tyvek®
Gloves – nitrile, vinyl, neoprene
Duct tape
Miscellaneous Equipment
Waterproof markers
Water jugs and sprayers
Hazardous materials packaging
Bubble wrap and tape for shipping
Cameras and film
Resealable plastic bags
Paper towels
Visqueen sheets
Buckets
Squirt bottle (wash)
Cotton gloves
Nalgene wash bottles
Reagent bottles
Coolers with foam dividers (sample transport and shipping)
Scrub brushes
Plastic tubs
Ice, in leak-proof bags
Drinking water

Table 2

Laboratory and Field Quality Control Sample Summary
Arsenic Quantification SAP
Univar Facility, Portland, Oregon

Matrix	QA/QC Analyses	Frequency
Laboratory		
Water	Laboratory control sample (LCS)	Every analytical batch
	MS/MSD	1 per 10 project samples
	Method blank	Every analytical batch
Field		
Water	Equipment blank	Provided by supplier
	Field blank	1 per 10 project samples
	Field duplicate	1 per 10 project samples

Table 3

Laboratory Deliverables
Arsenic Quantification SAP
Univar Facility, Portland, Oregon

The following deliverables will be required from the laboratory:

1) A transmittal letter and case narrative which includes information about receipt of the samples, the analytical results, and any significant problems in any aspect of sample analysis (e.g., deviation from methodologies or quality control).

2) Sample analytical results:
   a) Water results in mg/L or µg/L
   b) Method reporting limit for undetected values reported for each analyte on a sample-by-sample basis
   c) Date of sample preparation/extraction
   d) Date of sample analysis

3) Method blank results, including the samples associated with each blank

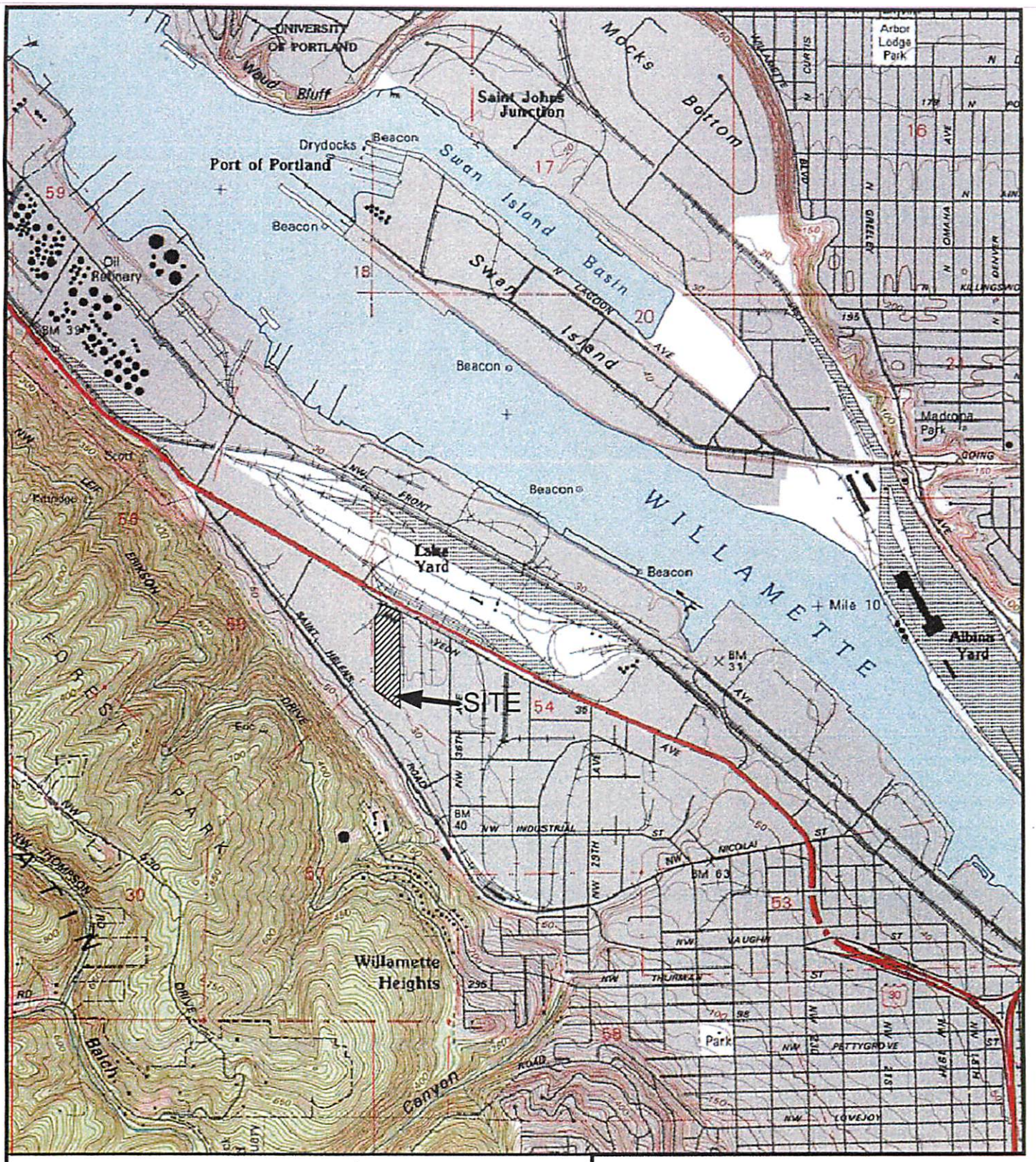
4) Surrogate recovery results, reported as percent recoveries, including actual spike levels

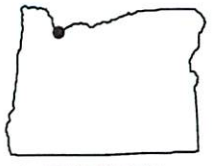
5) Laboratory duplicate results

6) MS/MSD results, reported as percent recoveries, including actual spike levels

7) Copies of signed chain-of-custody forms

ILLUSTRATIONS





N

SCALE

0 2000 4000 FEET

SOURCE:

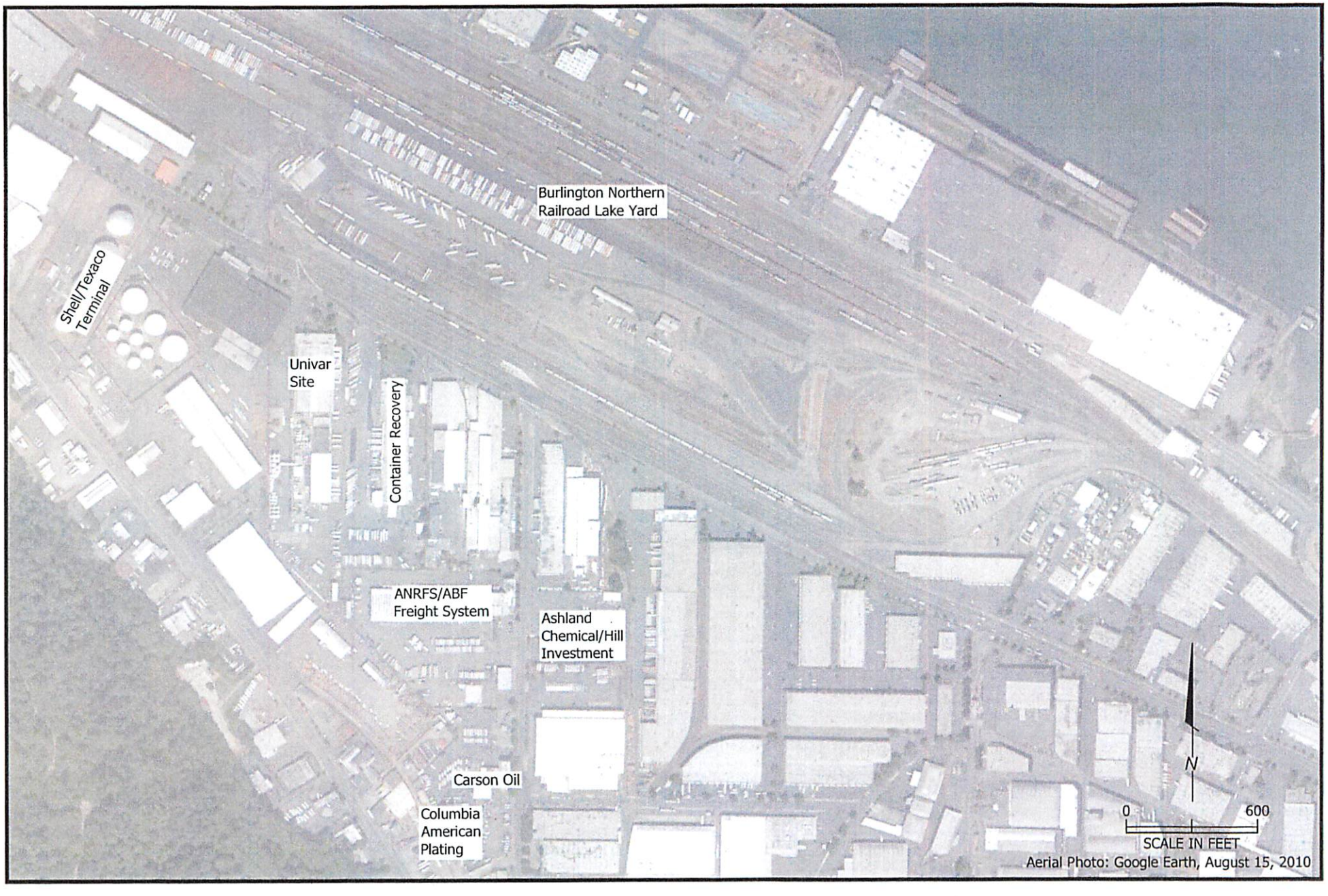
U.S.G.S. 7.5 Min. Quadrangle, PORTLAND, OR – WA 1961.

PES Environmental, Inc.
Engineering & Environmental Services

Site Location Map
Univar USA Inc.
Portland, Oregon

FIGURE
1

816.001.01.128	81600101128_SOB_F1		2/04
JOB NUMBER	DRAWING NUMBER	REVIEWED BY	DATE

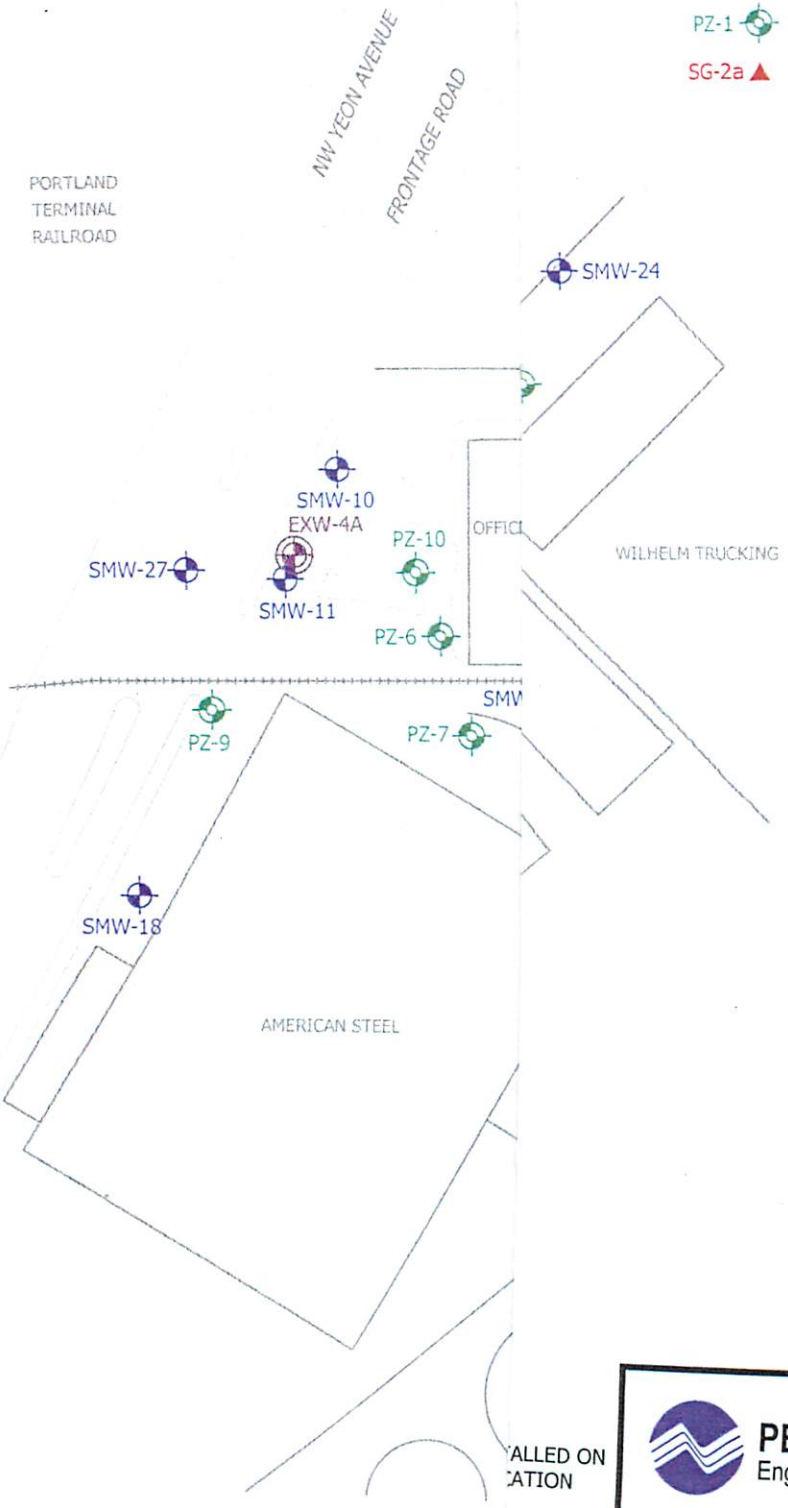


PES Environmental, Inc.
Engineering & Environmental Services

Surrounding Properties Location Map
Univar USA, Inc.
Portland, Oregon

FIGURE
2

816.001.01.128	81600101128_2	DRAFT	3/11
JOB NUMBER	DRAWING NUMBER	REVIEWED BY	DATE



PES Environmental, Inc.
Engineering & Environmental Services

Well and Piezometer Location Map
Univar USA Inc.
Portland, Oregon

FIGURE
3

816.001.01.128
JOB NUMBER

81600101128_TEM_3
DRAWING NUMBER

REVIEWED BY

3/11
DATE

PES Environmental, Inc.
Engineering & Environmental Services

Proposed Surface Water Sample Location
Univar USA, Inc.
Portland, Oregon

FIGURE
4

816.001.01.128	81600101128_4A	DRAFT	3/11
JOB NUMBER	DRAWING NUMBER	REVIEWED BY	DATE

APPENDIX A

FIELD FORMS

PES Environmental, Inc.
Engineering & Environmental Services

PAGE	OF
DATE:	

WATER LEVEL DATA FORM

PROJECT:	**Univar Portland**
JOB No:	**816.001.01.041**
PM:	**Matt Dahl**
RECORDED BY:	**JoAnne Ellis**

MEASURING INSTRUMENT:

☐ STEEL TAPE ■ INTERFACE PROBE

■ ELECTRONIC SOUNDER SERIAL No.

DATUM: ☐ MEAN SEA LEVEL ■ City of Portland

WELL I.D.	DEPTH TO WATER (ft)	TIME
Shallow Wells:		
SMW-1		
SMW-2		
SMW-3		
SMW-4		
SMW-5		
SMW-6		
SMW-7		
SMW-8		
SMW-9		
SMW-10		
SMW-11		
SMW-12		
SMW-13		
SMW-15		
SMW-16		
SMW-17		
SMW-18		
SMW-19		
SMW-20		
SMW-21		
SMW-22		
SMW-23		
SMW-24		
SMW-26		
SMW-27		

WELL I.D.	DEPTH TO WATER (ft)	TIME
Deep Wells:		
DMW-1		
DMW-2a		
DMW-3		
DMW-4		
DMW-5		
DMW-6		
DMW-7		
Pumping Wells:		
EXW-2		
EXW-3		
EXW-4A		
EXW-5A		
Piezometers:		
PZ-1		
PZ-2		
PZ-3		
PZ-4		
PZ-5		
PZ-6		
PZ-7		
PZ-8		
PZ-9		
PZ-10		
PZ-11		
PZ-12		
PZ-13		

WELL I.D.	DEPTH TO WATER (ft)	DEPTH TO NAPL (ft)	VACUUM (in.w.c.)	TIME
LNAPL Monitoring Wells:				
SMW-28				
SMW-29				
SMW-30				
SMW-31				
SMW-32				
SMW-33				
SMW-34				
SMW-35				
SMW-36				

WELL I.D.	DT-W (ft)	DT-NAPL (ft)	DT-B (ft)	TIME
DNAPL Monitoring Wells:				
SMW-37				
SMW-38				

WELL I.D.	VACUUM (in.w.c.)	TIME		
Vacuum Monitoring Points:				
VP-1				
VP-2				
VP-3				

PES Environmental, Inc.

Engineering & Environmental Services

Page:	of
Date/Time:	
Project Name:	
Job No:	
Recorded By:	
Sampled By:	

GROUNDWATER SAMPLING FORM

Well Type:	☐ Monitoring	☐ Extraction	☐ Other		Well No:
Well Material:	☐ PVC	☐ Stainless Steel	☐ Other		

WELL PURGING

PURGE VOLUME

Casing Diameter (D in inches)

☐ 2-inch ☐ 4-inch ☐ 6-inch ☐ Other _____

Total Depth of Casing (TD in feet below top of casing): _____

Water-Level Depth (WL in feet below top of casing): _____

Pump rate: approximately _____ mL/minute

PURGING METHOD

☐ Bailer - type: _____

☐ Submersible ☐ Centrifugal ☐ Bladder

☐ Peristaltic - Type: _____

PUMP INTAKE SETTING

☐ Bottom ☐ Top ☐ Middle: _____

Depth in feet (BTOC): _____

Screen interval feet (BTOC) from _____ to _____

FIELD PARAMETER MEASUREMENTS

START TIME: _____ STOP TIME: _____ TOTAL GALLONS REMOVED: _____

Time	Gallons Removed	pH	Conductivity (µmhos/cm)	Temperature (°C)	DTW (feet bgs)	ORP	DO	Observations (color, well condition, odor, cloudiness, etc.)

Notes:

WELL SAMPLING

☐ Bailer ☐ Peristalic

Sample No.	Time	Volume	Analyses	Bottle Type	Preservative

QUALITY CONTROL SAMPLES

Duplicate Sample No.	Time	Volume	Analyses	Bottle Type	Preservative
Field Blank Sample No.	**Time**	**Volume**	**Analyses**	**Bottle Type**	**Preservative**

PES Environmental, Inc.

Engineering & Environmental Services

Page:	of
Date/Time:	
Project Name:	
Job No:	
Recorded By:	
Sampled By:	

SURFACE WATER SAMPLING FORM

GPS Location:	**Sample Location ID:** **SW-**

WILLAMETTE RIVER DATA

Gage Height: Flow Rate: River Depth:

FIELD PARAMETER MEASUREMENTS

Time	pH	Conductivity (µmhos/cm)	Temperature (°C)	DO (mg/L)	ORP (mV)	Observations

Notes:

Weather:

SURFACE WATER SAMPLING PARAMETERS

☐ Grab sample with peristaltic pump

Sample ID.	Time	Volume (mL)	Analyses	Bottle Type	Preservative
		500	Total Arsenic (200.8)	Poly	HNO_3
		500	Dissolved Arsenic (200.8)	Poly	HNO_3
		250	Total Inorganic Arsenic (1632)	Poly	HCl
		250	Dissolved Inorganic Arsenic (1632)	Poly	HCl

QUALITY CONTROL SAMPLES

Sample ID.	Time	Volume	Analyses	Bottle Type	Preservative

DISTRIBUTION

ARSENIC QUANTIFICATION SAMPLING AND ANALYSIS PLAN
UNIVAR USA INC.
PORTLAND, OREGON

April 1, 2011

		Copy No.
1 Copy **1e-Copy**	**Oregon Department of Environmental Quality** Northwest Regional Water Quality 2020 SW Fourth Avenue, Ste. 400 Portland, Oregon 97201 Attention: Ms. Mer Wiren, P.E.	**1, e-Copy**
1 Copies **1e-Copy**	**U.S. Environmental Protection Agency** Region 10 Office 1200 Sixth Avenue, Suite 900, AWT-121 Seattle, WA 98101 Attention: Ms. Holly Arrigoni	**2, e-Copy**
1 e-Copy	**Univar USA Inc.** 4833 South Beech Street Morrison, CO 80465 Attention: Mr. George Sylvester	**e-Copy**
1 Copy	**Univar USA Inc.** 3950 NW Yeon Avenue Portland, Oregon 97210-1412 Attention: Mr. Rob Matteson	**3**
1 Copy	**PES Project File**	**4**